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Committee on the Peaceful Uses of Outer Space

Preliminary review of international documents relevant to the safety of nuclear power sources in outer space

Report by the International Atomic Energy Agency

I. Introduction

1. At its forty-third session, held in Vienna from 7 to 16 June 2000, the Committee on the Peaceful Uses of Outer Space noted that, in accordance with General Assembly resolution 54/67, the Scientific and Technical Subcommittee had continued its consideration of the item relating to the use of nuclear power sources in outer space. The Committee noted that, in accordance with the four-year work plan adopted by the Subcommittee at its thirty-fifth session (A/AC.105/697 and Corr.1, annex III, appendix), the Subcommittee had identified terrestrial processes and technical standards that might be relevant to nuclear power sources, including factors distinguishing nuclear power sources in outer space from terrestrial nuclear applications. The Committee also noted that the Subcommittee, at its thirty-seventh session, had reconvened the Working Group on the Use of Nuclear Power Sources in Outer Space. The Committee noted the discussions of the Subcommittee and its Working Group on the Use of Nuclear Power Sources in Outer Space, as reflected in the report of the Subcommittee and in the report of the Working Group (A/AC.105/736, paras. 75-83 and annex III).

2. In the report of the Working Group to the Subcommittee at its thirty-seventh session (A/AC.105/736, annex III, para. 6), the following international documents that might be relevant to the safety of nuclear power sources in outer space were identified:

(a) The provisions of the Convention on Nuclear Safety,[1] the Convention on Early Notification of a Nuclear Accident[2] and the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency;[3]

(b) The recommendations of the International Commission on Radiological Protection;

(c) The relevant Safety Series publications of the International Atomic Energy Agency (IAEA);

(d) The reports of the United Nations Scientific Committee on the Effects of Atomic Radiation.

3. The Working Group agreed that a review of those documents should be carried out within the context of the second year of its work plan in order to identify with more specificity those documents or parts of documents that might be of particular relevance to nuclear power sources in outer space. The Working Group welcomed the IAEA proposal to conduct such a preliminary review of the documents and requested IAEA to report on the matter at the thirty-eighth session of the Scientific and Technical Subcommittee, in 2001.

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4. The present report by IAEA to the Subcommittee at its thirty-eighth session is in response to that request.

II. Preliminary review of the identified documents

5. IAEA has been instrumental in the development of what is now widely recognized as a global safety culture for all applications of radiation and radioactive materials, comprising three elements: legally binding intergovernmental agreements; internationally agreed safety standards; and provision for the application of those standards.

A. Binding intergovernmental agreements

6. Three conventions are potentially relevant to the safety of nuclear power sources in outer space.

7. The Convention on Early Notification of a Nuclear Accident (the Early Notification Convention) entered into force in October 1986. It has 84 contracting parties (81 States and three international organizations).[4] The facilities and activities to which the Convention relates include, inter alia, "any nuclear reactor wherever located" and "the use of radioisotopes for power generation in space objects." The Convention applies in the event of any accident involving any such facility or activity under the jurisdiction or control of a State Party "from which a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another State." In the event of such an accident, the relevant State party shall "forthwith notify ... those States which are or may be physically affected ... of the nuclear accident, its nature, the time of its occurrence and its exact location where appropriate" and "promptly provide [those] States ... with such available information relevant to minimizing the radiological consequences in those States, as specified in article 5."[5] Each State party is also required by the Convention to make known to the other States parties "its competent authorities and point of contact responsible for issuing and receiving the notification and information referred to". In each case, States parties may provide notification and information directly or through IAEA. In practice, IAEA is normally used as an intermediary.

8. All of the States operating nuclear power sources in outer space are parties to the Early Notification Convention. Any accident involving such a source that could lead to radioactive material re-entering the Earth's atmosphere would therefore be potentially within the scope of the Early Notification Convention.

9. The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (the Assistance Convention) entered into force in February 1987. It has 79 contracting parties (76 States and three international organizations).[4] The Convention requires the States parties to "cooperate between themselves and with the International Atomic Energy Agency ... to facilitate prompt assistance in the event of a nuclear accident or radiological emergency to minimize its consequences and to protect life, property and the environment from the effects of radioactive releases." Although many of the specific obligations concern the provision of assistance by States parties to other States parties, the Convention requires IAEA to "respond, in accordance with its Statute and as provided for in this Convention, to a requesting State Party's or *a Member State's* request for assistance in the event of a nuclear accident or radiological emergency" (emphasis added).

10. In addition to the reactive functions set out in the Assistance Convention, the States parties in article 5 request IAEA:

(a) To collect and disseminate information concerning experts, equipment and materials that could be made available in the event of an emergency and on relevant methodologies, techniques and research findings;

(b) To assist States on request in preparing emergency plans and legislation and in developing training or environmental monitoring programmes.

Again, IAEA is requested to perform those functions in relation to Member States as well as States parties.

11. The Convention on Nuclear Safety entered into force in October 1996. It has 53 contracting parties (52 States and the European Atomic Energy Community (EURATOM)). It is somewhat different in nature from the Early Notification Convention and the Assistance Convention, in that its main focus is on encouraging contracting parties to pursue agreed

nuclear safety objectives by fulfilling specific safety obligations at the national level. The international dimension takes the form of peer review: each contracting party is required to report periodically on the steps it has taken with regard to the specific obligations set out in the Convention, and those reports are reviewed by the other contracting parties.

12. The scope of the Convention on Nuclear Safety is explicitly restricted to land-based civil nuclear power plants and associated on-site handling, treatment and storage facilities. The Convention does not therefore apply to nuclear power sources in outer space, and contains no provision for reporting on or reviewing safety measures taken in relation to such sources. Nevertheless, the safety objectives and, where relevant, the specific safety obligations set out in the Convention may still be applicable to some extent. In particular, it might be difficult for States that have agreed to be bound by the Convention on Nuclear Safety to argue that the nuclear safety principles embodied in the Convention need not be applied to certain facilities or activities solely because they do not fall within the formal scope of the Convention.

B. Internationally agreed safety standards

13. IAEA is unique among international organizations concerned with nuclear energy or radiation issues in having a statutory function to "establish or adopt ... standards of safety for protection of health and minimization of danger to life and property".[6]

14. IAEA safety standards fall into three categories:

(a) Safety Fundamentals, which present basic objectives, concepts and principles of safety and protection in the development and application of nuclear energy for peaceful purposes;

(b) Safety Requirements, which establish the requirements that must be met to ensure safety;

(c) Safety Guides, which recommend actions, conditions or procedures for meeting safety requirments.

15. Five broad areas of safety covered by IAEA safety standards ae as follows:

(a) Nuclear safety: the safety of nuclear installations;

(b) Radiation safety: radiation protection and the safety of radiation sources;

(c) Waste safety: the safety of radioactive waste management;

(d) Transport safety: the safety of transport of radioactive materials;

(e) General safety: those issues common to two or more of the above-mentioned safety areas, such as legal and governmental infrastructure, emergency preparedness and response and quality assurance.

16. In the area of nuclear safety, the Safety Fundamentals publication entitled *The Safety of Nuclear Installations*,[7] sets out the basic objectives, concepts and principles for ensuring safety. In describing the scope of the publication, it is stated that: "These principles, since they are fundamental in nature, are applicable to a broad range of nuclear installations, but their detailed application will depend on the particular technology and the risks posed by it." Existing IAEA safety standards in the Safety Requirements and Safety Guides categories specifically address either nuclear power plants or research reactors. It may therefore be concluded that the general principles derived from the Safety Fundamentals could be applicable to the safety of nuclear power sources in outer space, in particular nuclear reactors, but that the more detailed Safety Requirements and Safety Guides are unlikely to be useful.

17. The radiation safety standards are set forth in the Safety Fundamentals publication entitled *Radiation Protection and the Safety of Radiation Sources*[8] and in *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*[9]—commonly referred to as the Basic Safety Standards—which have the status of Safety Requirements. Both sets of standards are sponsored by IAEA and five other international organizations.[10] The publications set out, respectively, the basic objectives, concepts and principles of radiation protection (controlling exposure due to radiation sources) and radiation safety (keeping radiation sources under control and preventing accidents) and the requirements necessary to comply with those principles. Of particular relevance in the context of nuclear power sources in outer space are the principles of and requirements for

both the safety of radiation sources and intervention. Intervention is a radiation protection term to refer to actions taken to prevent or reduce radiation exposure, for example, in the event of an accident that results in a radiation source being out of control, and to mitigate the consequences thereof. The principles of and requirements for intervention therefore underpin the more specific requirements and guidance for emergency preparedness and response.

18. In the general safety area, the safety standards on preparedness for and response to nuclear and radiological emergencies are currently being revised. It is envisaged that a Safety Requirements publication (sponsored by the Food and Agriculture Organization of the United Nations, the World Health Organization (WHO), IAEA and the Nuclear Energy Agency (NEA) of the Organization for Economic Cooperation and Development (OECD), and two Safety Guides—covering, respectively, preparedness (sponsored by WHO, IAEA and OECD/NEA) and criteria for planning the response to an emergency—will be issued in 2002. Those publications will provide specific recommendations and guidance, building upon the general requirements of the Basic Safety Standards, in particular those related to intervention, and will supersede the existing safety standards specifically concerned with emergencies. In addition, a Safety Practice publication, entitled *Emergency Planning and Preparedness for Re-entry of a Nuclear Powered Satellite*,[11] was issued in the IAEA Safety Series in 1996. The publication provides examples of experience and good practice from Member States, but is not considered a safety standard of the Agency, since it does not specify requirements or recommendations.

III. Provision for the application of Agency safety standards

19. IAEA provides for the application of its safety standards in five main ways, as follows:

(a) Providing direct safety-related assistance to Member States, mostly through its technical cooperation programme;

(b) Fostering the exchange of safety-related information;

(c) Promoting education and training in safety-related subjects;

(d) Supporting safety-related research and development;

(e) Rendering, on request, a range of safety-related services.

20. In relation to the safety of nuclear power sources in outer space, information exchange may be the most significant function. In addition to the above-mentioned Safety Practice publication, IAEA has issued a number of publications providing information on specific issues relevant to radiological emergencies, such as the medical treatment of people accidentally exposed to radiation and countermeasures and recovery operations after an accident.

21. It should also be noted that a number of the IAEA activities discussed above in the context of the Assistance Convention, such as providing assistance, advice or training in the field of emergency planning, could also have been viewed as providing for the application of safety standards.

IV. Conclusion

22. Three binding intergovernmental agreements are potentially relevant to the safety of nuclear power sources in outer space. The following salient points regarding the agreements should be noted:

(a) The Convention on Early Notification of a Nuclear Accident entered into force in October 1986. All the States operating nuclear power sources in outer space are parties to the Early Notification Convention. Any accident involving such a source which could lead to radioactive material re-entering the Earth's atmosphere would therefore be potentially within the scope of the Early Notification Convention;

(b) The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency entered into force in February 1987. The Assistance Convention requires the States parties to "cooperate between themselves and with the International Atomic Energy Agency ... to facilitate prompt assistance in the event of a nuclear accident or radiological emergency to minimize its consequences and to protect life, property and the environment from the effects of radioactive releases." This would be applicable in the case of an accident involving nuclear power sources re-entering the Earth's atmosphere;

(c) The Convention on Nuclear Safety entered into force in October 1996. The Convention does not apply to nuclear power sources in outer space, and contains no provision for reporting on or reviewing safety measures taken in relation to such sources. Nevertheless, the safety objectives and, where relevant, the specific safety obligations set out in the Convention may still be applicable to some extent. That issue is further developed in the report prepared by the Chairman of the Working Group on the Use of Nuclear Power Sources in Outer Space under paragraph 7 of the report of the Working Group on its deliberations during the thirty-seventh session of the Scientific and Technical Subcommittee (A/AC.105/736, annex III).

23. In view of the IAEA Safety Series publications, and given that provision for the safety of nuclear power sources in outer space would involve both the prevention of accidents that could cause the radioactive material in the power source to be released and the protection of the population if such an accident were to occur, it follows from the above considerations that the IAEA nuclear safety standards would be relevant to the prevention of accidents related to nuclear reactors (that issue is also further developed in the report prepared by the Chairman of the Working Group under paragraph 7 of the above-mentioned report of the Working Group).

24. The radiation safety standards would cover the prevention of all other accidents that might lead to the dispersal of the radioactive material in the nuclear power source. The mitigation of the radiological consequences of any accident would be covered by safety standards on emergency preparedness and response. Three sets of circumstances would have to be considered: those prevailing before the launch, during the launch and during the operation of the nuclear power source in outer space. An additional report would then be necessary to address that aspect, taking into account the radiation safety standards as well as the Early Notification Convention and the Assistance Convention.

25. The foregoing conclusion covers the international documents listed above in paragraphs 2 (a) and (c) that might be relevant to the safety of nuclear power sources in outer space, as identified by the Working Group. During the preparation of such documents, IAEA takes account of the findings of the United Nations Scientific Committee on the Effects of Atomic Radiation, identified in paragraph 2 (d), and the recommendations of international expert groups, notably the International Commission on Radiological Protection, identified in paragraph 2 (b), and the International Nuclear Safety Advisory Group. However, new documents, recently published or in preparation, might also be relevant. One example, publication 82 of the International Commission on Radiological Protection, relating to the protection of the public in situations of prolonged radiation exposure, would be relevant in the case of an accident leading to widespread contamination and prolonged exposure of the public. The recently published documents should be considered in the additional report recommended above.

Notes

[1] International Atomic Energy Agency, "Convention on Nuclear Safety" (INFCIRC/449).

[2] United Nations, *Treaty Series*, vol. 1439, No. 24404.

[3] Ibid., vol. 1457, No. 24643.

[4] The Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO) and the World Meteorological Organization (WMO).

[5] Article 5 lists several specific items of information to be provided, relating to the accident, the release, protective measures and monitoring results.

[6] By article III, section A, paragraph 6, of its Statute, IAEA is authorized to "establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to providce for the application of these standards to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of atomic energy".

[7] IAEA, Safety Series No. 110 (STI/PUB/938) (Vienna, 1993).

[8] IAEA, Safety Series No. 120 (STI/PUB/1000) (Vienna, 1996).

[9] IAEA, Safety Series No. 115 (STI/PUB/996) (Vienna, 1996).

[10] ILO, FAO, WHO, the Nuclear Energy Agency of the Organization for Economic Cooperation and Development and the Pan American Health Organization.

[11] IAEA, Safety Series No. 119 (STI/PUB/1014) (Vienna, 1996).